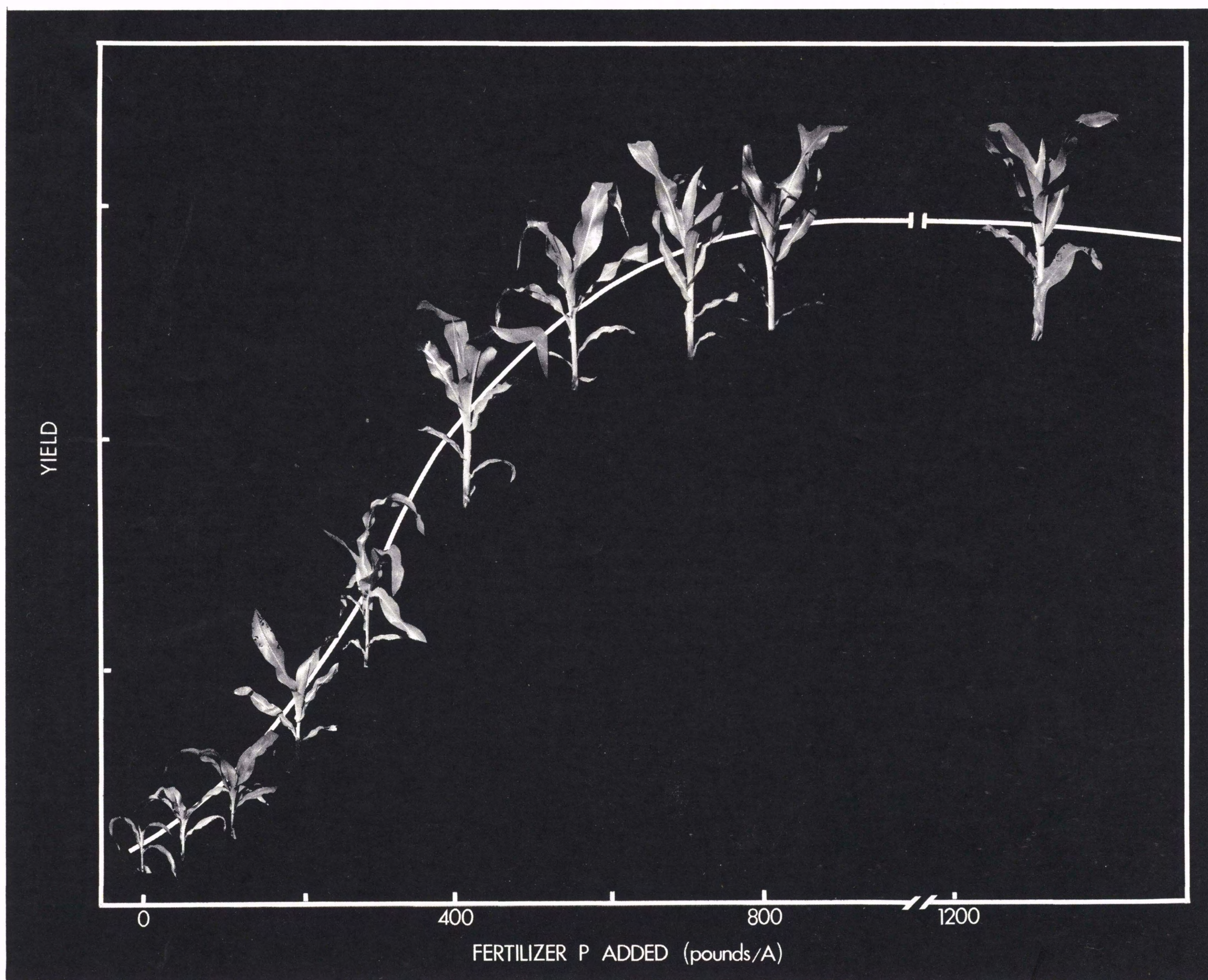


ILLUSTRATED CONCEPTS IN TROPICAL AGRICULTURE
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GROWTH RESPONSE CURVES—THE “LAW OF DIMINISHING RETURNS”



When all growth factors except one are adequately supplied, adding increments of the limiting growth factor will increase yields. One of the best known attempts to express growth curves mathematically was that of Mitscherlich. His equation predicts that each succeeding increment of growth factor (a plant nutrient, for example) will produce a smaller increment of growth than the preceding increment. The Mitscherlich yield response curve is an example of a well-known concept in economic theory—the law of diminishing returns. The equation has the form

$$\frac{dy}{dx} = (A-y)C$$

where dy is yield increase from an increment of growth factor dx , A is maximum yield attainable as the result of adding an unlimited amount of growth factor, y is the yield obtained after any given quantity of the factor x has been applied, and C is a proportionality constant.

Actual yield response curves always pass through a maximum; and, excess nutrient depresses yield. Sometimes initial increments of added nutrient are so immobilized by the soil or utilized by soil organisms or weeds that they increase growth less than later increments.

The pictorial graph is an actual yield response curve for corn growing on a very phosphate-deficient soil (Tropeptic Eutrustox, Wahiawa series) on Oahu. Per unit of phosphate added, the first and last increments were less effective for increasing growth than were intermediate increments. However when yields were plotted against adjusted concentrations of phosphate in the soil solutions, a method for evaluating phosphate availability, a normal growth response curve was obtained.